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PALLIATIVE CHAIR

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ABSTRACT

In different sectors of industry, sedentary employment frequently results in physical discomfort and pain, which lowers productivity. With the purpose of reducing pain and enhancing wellbeing, a modified palliative chair is suggested. The chair offers support for the lower back, neck, and shoulders and incorporates on demand massage and heat treatment elements. The research on the health advantages of massage and heat therapy is discussed, emphasizing their potential to lessen the adverse consequences of extended sitting. The adopted design may increase productivity and well-being, which would be advantageous to both employers and employees. To completely comprehend the effectiveness and user satisfaction of this technology, more research is required. Employees can improve their physical well-being while at work with the help of this updated ergonomic chair design.

KEYWORDS: Sedentary employment, Ergonomic chair design, Massage therapy, Heat treatment, Productivity, Workplace well-being.

INTRODUCTION

Sitting for extended periods of time is becoming common in fields such as information technology, higher education, and management positions. This can result in physical discomfort and suffering, which in turn lowers productivity. While designed to support and comfort workers during long shifts, ergonomic chairs may not always be able to fully alleviate the pain and discomfort brought on by prolonged sitting. In response, we suggest a modified palliative chair with features for on demand heat therapy and massage to reduce pain and enhance physical well-being.

This review paper examines how the suggested modified palliative chair design can help sedentary workers. We will go over the research on the health advantages of massage and heat therapy, emphasising how they might lessen the impacts of prolonged sitting. We will also look at the difficulties and restrictions that come with using this technology, such as the price, technical needs, and user preferences.

This redesigned ergonomic chair design has the potential to increase productivity and well-being, benefiting both individuals and employers, by offering an affordable option for professionals to improve their physical well-being while at work. Other fields that necessitate extended sitting, such call centers and financial institutions, may benefit from the proposed design. To completely comprehend the effectiveness and user satisfaction of this technology, more research is required.

LITERATURE SURVEY

In their study, Mohanty et al [1] provide a comprehensive approach that combines statistics and artificial intelligence to create industrial or office workspaces that consider the physical and psychological needs of employees, resulting in greater effectiveness and production. They use measurements from the Bureau of Indian Standards to conduct a case study on office chair design to evaluate their methodology. The authors discover that creating items with the best criteria can increase customer attractiveness while minimizing user weariness and damage. Workplace settings can be created to encourage productivity and well-being by considering the physical and psychological demands of employees.

According to Samad [2], ergonomics is becoming increasingly crucial in boosting efficiency, safety, and comfort in industrial production as technology progresses. Ergonomics seeks to optimize the interaction between people, tools, and the workplace, which includes designing tools and equipment to match the worker's demands and tailoring the environment to the worker's requirements. Backaches, neck pain, and muscle strains caused by inadequate seating and posture are major concerns in ergonomics. This can be addressed by creating pleasant and user-friendly workplaces, giving workers with ideal surroundings, lowering physical workload, and optimizing working postures.

Chandra et al [3], highlights how the advancement of information technology has resulted in the establishment of "office ergonomics," which entails creating desks, workplaces, and workstations that may be utilised by different persons at different times. This includes examining corporate operations and creating workstations with furniture, equipment, computer systems, and environmental aspects in mind. Overexertion and repetitive strain injuries at work underscore the need for a better understanding of workplace ergonomics and workstation design, especially in flexible office employment. The paper includes an in-depth examination of these problems, as well as the development of flexible office design to reduce negative consequences and boost good ones, while also emphasising worker health and safety and analyzing the critical ergonomic challenges in office work.

The COVID-19 epidemic has raised demand for ergonomic computer workstation chairs, as more individuals work from home using computers. According to Math et al [4], the global market for these chairs is predicted to reach $ 29.67 billion. In response to this desire, the authors created an ergonomic office chair for laptop users using Indian anthropometric data and Solid Works, with the purpose of decreasing muscular tension and increasing productivity. A CAD model of the workstation's parts was created using design inputs derived from common human traits. This project focuses on laptop users, who have fewer ergonomic design requirements than desktop users.

Xu et al [5] emphasize the relevance of employing ergonomic principles to analyze human sitting position and dynamic behaviour in current office work. To produce new design concepts for office chairs that are pleasant, productive, and safe for human health, extensive research is required. Modern office chairs should be constructed with the body's posture in mind to reduce negative health impacts while also promoting comfort and productivity. The authors recommend that while designing ergonomic workplace chairs, numerous elements be considered, including human posture and interactions between people and seats. The authors illustrate how to develop safe and comfortable workplace chairs by using design examples that combine ergonomics concepts. By taking these factors into consideration, ergonomic office chairs can increase workplace efficiency while decreasing the risk of musculoskeletal issues.

Employees must sit in a supported and comfortable position in office chairs because many modern western jobs require them. A study was done by Roland Zemp et al [6] to evaluate the precision of objective methods for calculating sitting comfort. They discovered a relationship between users' perceived levels of comfort or discomfort and office chair pressure measures, suggesting that pressure readings may provide some insight into how comfortable users are. To completely comprehend the connection between objective metrics and unique sitting comfort experiences, more investigation is necessary. The study stresses how important it is to evaluate office chair ergonomics and design from both an objective and subjective standpoint.

In their overview of international ergonomics regulations and recommendations for designing computer workstations, E.H.C. Woo et al [7] note the variations and their effects on health issues. To address the accelerating development of computer technology and its effects on computer users' health and wellbeing, they offer arguments and suggestions for modifications to the current standards and guidelines. The best practises for input devices, visual displays, lighting, environmental factors, and furniture arrangement and design are suggested in the article. The authors stress the significance of upholding current ergonomics norms and recommendations in order to reduce the risk of health problems

brought on by prolonged computer use. This article serves as a foundation for the development of new guidelines and standards that are better suited to meet the changing needs of computer users.

A new work seat for industrial sewing operations was designed by Chi-Yuang Yu et al [8], considering the biomechanical geometry of a low sit-stand posture. The traditional seat resembled an office chair, whereas the new seat had a pelvic support, thigh support, lumbar support, and thoracic support. According to the research, the novel seat was superior to the conventional seat in lowering trunk and upper-limb muscle activity. The findings imply that by minimizing muscle activity in the trunk and upper extremities, a well-designed work seat with precise seat-pan and backrest features can improve industrial workers' ergonomic performance. The study highlights the significance of creating work seats that take into account the biomechanical geometry of a low sit-stand posture for the comfort and productivity of workers.

Figure 1 : Massage Chair (BEG-100)

Using a newly created massage chair as shown in figure 1, Lee et al [9] conducted a clinical trial on 38 children aged 11 with heights ranging from 145.0 to 155.0 cm to examine the possibility of a 24-week massage for promoting growth. After focusing on the knee and ankle areas, the massage chair stretches the areas around the knee to help youngsters who desire to accelerate their growth. The goal of the study was to assess changes in body mass index, height percentile, height, bone age, growth rate, and anticipated height calculated from bone age. Investigating related adverse events helped determine safety. This study is unique since it is one of the few to look at the impact of massage on growth after infancy.

A dynamic seat that promotes pelvic motion has been created by Kuster et al [10] and has the potential to enhance physical well-being and lessen the hazards to health brought on by extended sitting. Office employment, however, also necessitates a secure position for the upper body and head to preserve excellent vision. The researchers adjusted current dynamic office chairs to conform to the natural kinematics of the human spine in order to address this. Both a secure upper body posture and supportive pelvic movement are provided by the resulting seat. It enables the spine to bend widely to the side, much like when walking, but still maintaining a secure position for job duties. With the stability required for office work, this invention offers a viable way to reduce the negative effects of extended sitting.

According to Hailee et al [11], repetitive jobs, excessive pressure, and uncomfortable postures increase the risk of musculoskeletal injuries in healthcare professionals who manually treat patients. The depot wheelchair, which has few adjustments and is frequently utilised because it is inexpensive, is the patient transport chair that is most frequently used in healthcare settings. Nonetheless, patients and carers may have discomfort and musculoskeletal problems as a result of depot wheelchairs' lack of adjustability. In order to lower the risk of musculoskeletal injuries and enhance the wellbeing of healthcare professionals who handle patients manually, this emphasises the need for better ergonomic designs in patient transport chairs.

For patients to continue their daily activities and to avoid developing pressure ulcers, a decent chair cushion is essential as emphasized by Mooney et al [12]. The ideal cushion should be stable, light, low-maintenance, long-lasting, and reasonably priced. It should also evenly distribute pressure to prevent interfering with capillary blood flow to bony areas of the skin. These requirements appear to be met by an experimental design using resin-impregnated polyurethane foam with a cut-out area beneath the ischial tuberosity. The foam is stable, evenly distributes pressure over a sizable skin area, needs little upkeep, and has a long-lasting covering.

Dhingra et al [13] provides an overview of the elements, such as static and dynamic pressure distribution, low back pain, seat design, and safety, that influence comfort in the seat-operator interface. According to the research, soft seats have a pressure distribution that is more evenly distributed across a larger effective contact area than rigid seats. The seat height, posture, cushion type, frequency, and vibration all have an impact on how the pressure is distributed. Increased excitation magnitude results in higher ischium pressure and an effective contact area at frequencies between 4.5 and 5.0 Hz. Dynamic pressure at the interface is sinusoidal and ranges from 1 to 10 Hz. Postural stress, whole-body vibration, and shocks are the three main causes of low back pain, but they can be prevented by using the right kind of cushion and lumbar and side support.

Extended sitting can cause changes in the passive stiffness of the lumbar spine, increasing the risk of low back injury. The study by Beach et al [14] quantify time-varying changes in passive flexion stiffness of the lumbar spine caused by extended sitting and to see if men and women respond differently. Participants were asked to sit for two hours while their lumbar flexion/extension postures and extensor muscle activation levels were measured. Men's lumbar spine stiffness rose after 1 hour of sitting, whereas women's reactions were mixed. In the second hour of sitting, men adjusted for increased stiffness by assuming reduced lumbar flexion. Changes in lumbar spine passive flexion stiffness caused by extended sitting may increase the risk of low back injury and contribute to low back pain.

The study by Davis et al [15] looked at how call center workers posture, pain, and productivity were affected by workstation interventions. Four different workstation settings were used in the intervention: traditional, sit-stand, traditional with reminder software, and sit-stand with reminder software. The findings indicated that the reminder software was useful in easing pain in a variety of bodily regions, including the shoulder, hand/wrist, upper back, and lower back, and had a minor beneficial influence on productivity. The sit-stand desk was similarly successful in easing discomfort while maintaining productivity. Hence, with minimal impact on productivity, regular pauses that promote postural modifications can help lessen the harmful consequences of extended static postures, which are frequently observed in office work.

Based on a modified version of Yan's creative design process, Tzu-Hsia Chen et al [16] provide a systematic technique for designing massage mechanisms for massage chairs. The 14 design options they come up with, including the "Curried Cut" design concept, which involves kinematic design, engineering drawing, and prototype production, are based on an examination of the existing massage mechanisms with beating and kneading functions. The novel design, which can provide a wider variety of non-uniform output motion than earlier versions, is simulated by the authors. This study sheds light on how to improve massage quality by optimizing motion parameters. Overall, the article offers a useful method for creating massage mechanisms for massage chairs that can assist product designers in meeting consumer desires for synchronizing ergonomics, aesthetics, and functionalities.

In order to assess the user's feelings during a massage, Kazuya Hiyamizu et al [17] created a "Human Feel Sensor" that can monitor the temperature, pulse, and Galvanic Skin Response (GSR) of the peripheral skin in real-time. The authors developed a method of controlling a massage chair such that it responds to the user's experiences using data from a sensor. This method enables the massage chair to alter the massage programme in real-time to deliver a more customised and effective treatment. The study offers a novel method for enhancing the massage experience by analyzing the user's physiological responses using state-of-the-art sensor technology and changing the massage programme accordingly. Future designs of massage chairs and other massage equipment will be significantly impacted by the findings.

Salinee Rattanaphan et al [18] sought to design and create a massage chair capable of replicating the three basic Thai massage techniques, namely pull, press, and pin. The project was divided into three phases: research, design, and prototype and testing. Throughout the research phase, the researchers investigated Thai massage thoroughly in order to understand its principles and methods. During the design phase that followed, they created a massage chair that could mimic the 3P technique utilised by human masseurs. The massage chair was then built and tested in Bangkok with 40 potential buyers. The results of the tests revealed that the chair performed satisfactorily and provided a more human-like massage than existing roller-type massage chairs

To provide thermal stimulation using heating pads placed on the skin's surface, Pathan Fayaz Khan et al [19] suggested a revolutionary digital proportional integral (PI) controller architecture based on the Arduino microcontroller. The purpose of the study was to determine whether an electric heating pad's thermode might be utilised in a specialised, inexpensive contact heat evoked potentials (CHEP) stimulator. The PI controller is intended to produce desired temperatures in a pattern chosen by the user on the surface of the heating pad. The transfer function of the heating system was evaluated, and the design parameters for the controller were established, using a parametric system identification approach. The architecture of the suggested PI controller may facilitate the design of low-cost, specialised CHEP stimulators for therapeutic applications.

In a study by Hongxiang Shan et al [20], the information architecture and interaction style of the massage chair interface were examined in connection to human factor challenges. To investigate the problems with the massage chair controller's human component, the researchers ran two experiments: an assessment experiment and an eye movement experiment. The findings of the study can serve as the foundation for creating the ideal smartphone interface for the Internet of Things. The study emphasises how crucial it is to take user experience and other human variables into account when creating user interfaces for smart devices. In order for massage chairs and other Internet of Things devices to work as planned and give users a good experience, the study stresses how important interface design is.

The incorporation of a vibration motor and heating elements into an existing ergonomic chair has the potential to significantly benefit persons who suffer from back pain as a result of extended sitting. Massage and heat therapy can increase circulation and relieve muscle tension, offering much-needed relief from the physical strain associated with prolonged sitting.

These characteristics can also improve the chair's general comfort and usability, making it a more appealing alternative for people who spend a large amount of time sitting at a desk or workplace. This can lead to higher productivity and a happier workplace.

The accompanying figure illustrates the design of a palliative chair that has been enhanced with the integration of vibration motors and heating elements, showcasing the specific placement and arrangement of the massage nodes and heating elements within the backrest and seat.

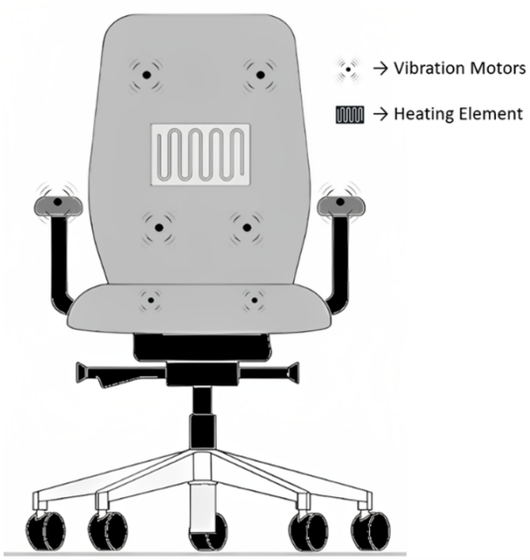

Figure 2 : Proposed Illustration

CONCLUSION

Ergonomics seeks to improve the interaction of people, tools, and the workplace to increase productivity, safety, and comfort. Ergonomic office chairs that consider human posture and sitting comfort, as well as innovative work seats that include biomechanical geometry, have been developed as a result of research. The pandemic of COVID-19 has raised demand for ergonomic computer workstation chairs. Creating ergonomic workspaces that consider employees' physical and psychological demands can boost productivity and well-being. Based on a review of the literature, a modified palliative chair with on-demand massage therapy and heat treatment is offered as a less expensive and more space-efficient alternative to typical massage chairs. Industries might use this chair to provide healthcare to employees while still allowing them to work.

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